

CORRECTING FOR ATTENUATION EFFECTS IN OPTICAL PATTERNATION OF SPRAYS

DEMONSTRATION OF CORRECTION
METHODOLOGY DEVELOPED BY
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AIR FORCE CONTRACT F04611-97-C-0084

20021030 064

Distribution statement: Approved for public release; distribution unlimited.

MOTIVATION

- “OPTICAL PATTERNATION” OF SPRAYS
 - PLANAR LASER INDUCED FLUORESCENCE APPROACH
 - DISTRIBUTION OF MASS THROUGHOUT SPRAY
 - NON-INTRUSIVE
 - RAPID
 - GAINING ACCEPTANCE AS SPRAY DIAGNOSTIC
- BARRIERS TO QUANTITATIVE RESULTS
 - CAMERA RESPONSE ISSUES
 - ATTENUATION OF EXCITING LIGHT
 - ATTENUATION OF SIGNAL LIGHT

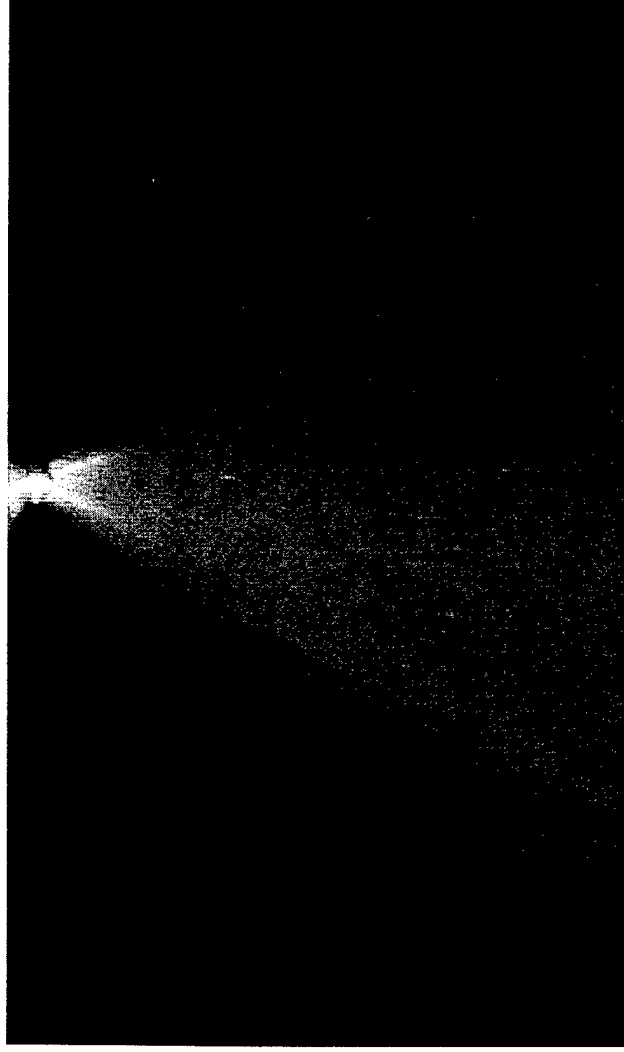
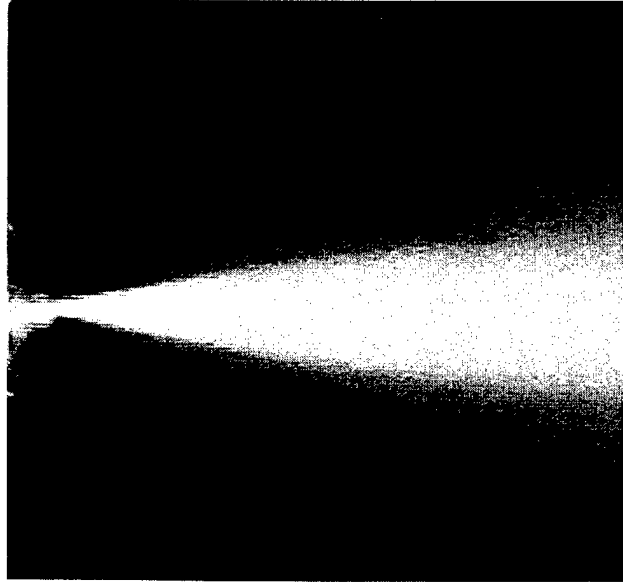
ADDRESSING BARRIERS

- NOVEL METHODOLOGY HAS BEEN DEVELOPED TO
SIMULTANEOUSLY ACCOUNT FOR ATTENUATION OF
 - EXCITATION LIGHT
 - SIGNAL LIGHT

DEMONSTRATION STUDY

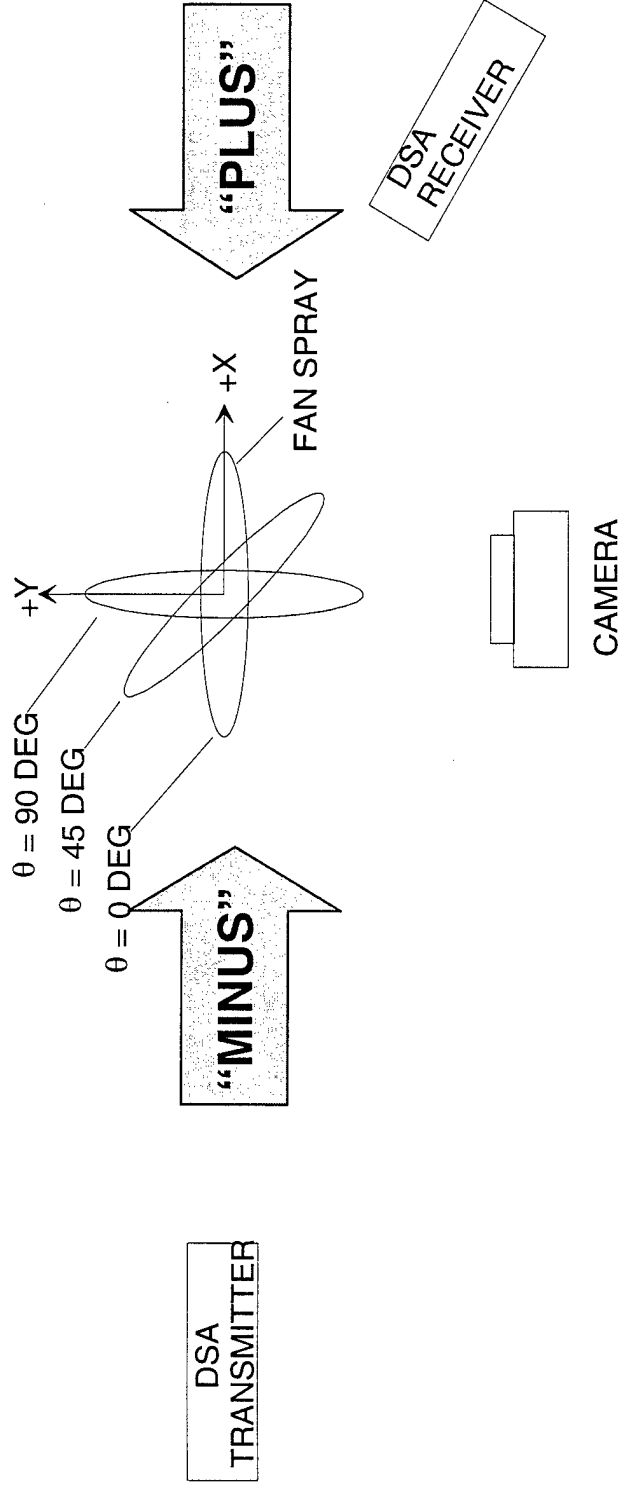
TWIN-FLUID FAN SPRAY:

- **CONTROLLED ATTENUATION EFFECTS**
- **SYMMETRIC ELLIPTIC DISTRIBUTION**



DEMONSTRATION STUDY

• TOP VIEW ORIENTATION



ATTRIBUTES:

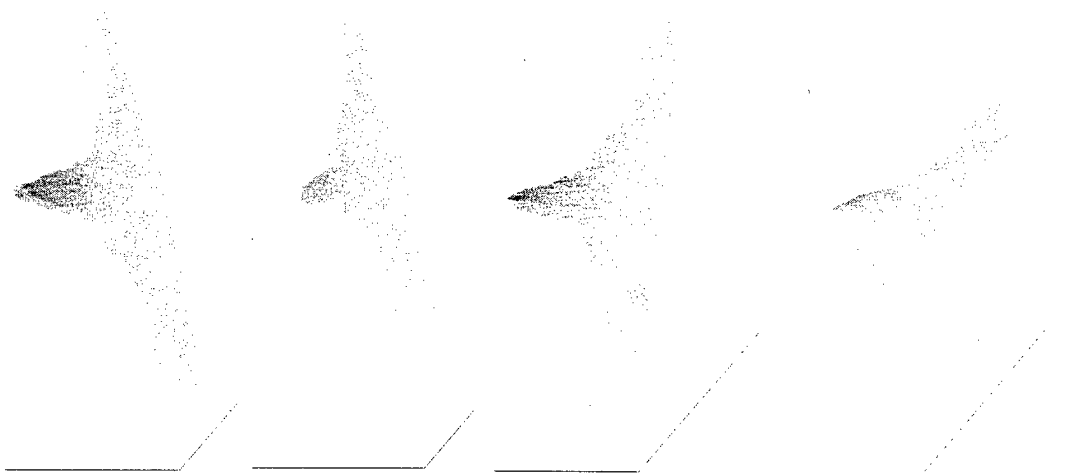
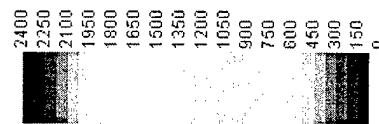
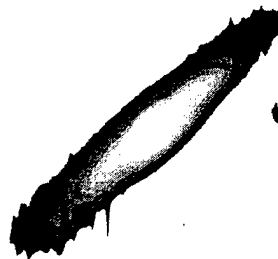
0-DEG: MAXIMUM INCIDENT LIGHT ATTENUATION

90-DEG: MAXIMUM SIGNAL ATTENUATION

45-DEG: MINIMUM INCIDENT LIGHT OR SIGNAL ATTENUATION

DEMONSTRATION STUDY

• UNCORRECTED IMAGES



0 DEG

0 DEG
REV.

45 DEG

90 DEG

DEMONSTRATION STUDY

- IMPORTANCE OF CORRECTION: UPPER AND LOWER IMAGES SHOULD BE IDENTICAL BUT ROTATED

**CORRECTION FOR
INCIDENT LIGHT
ONLY**

**PRESENT FULL
CORRECTION**

UNCORRECTED

0 DEG

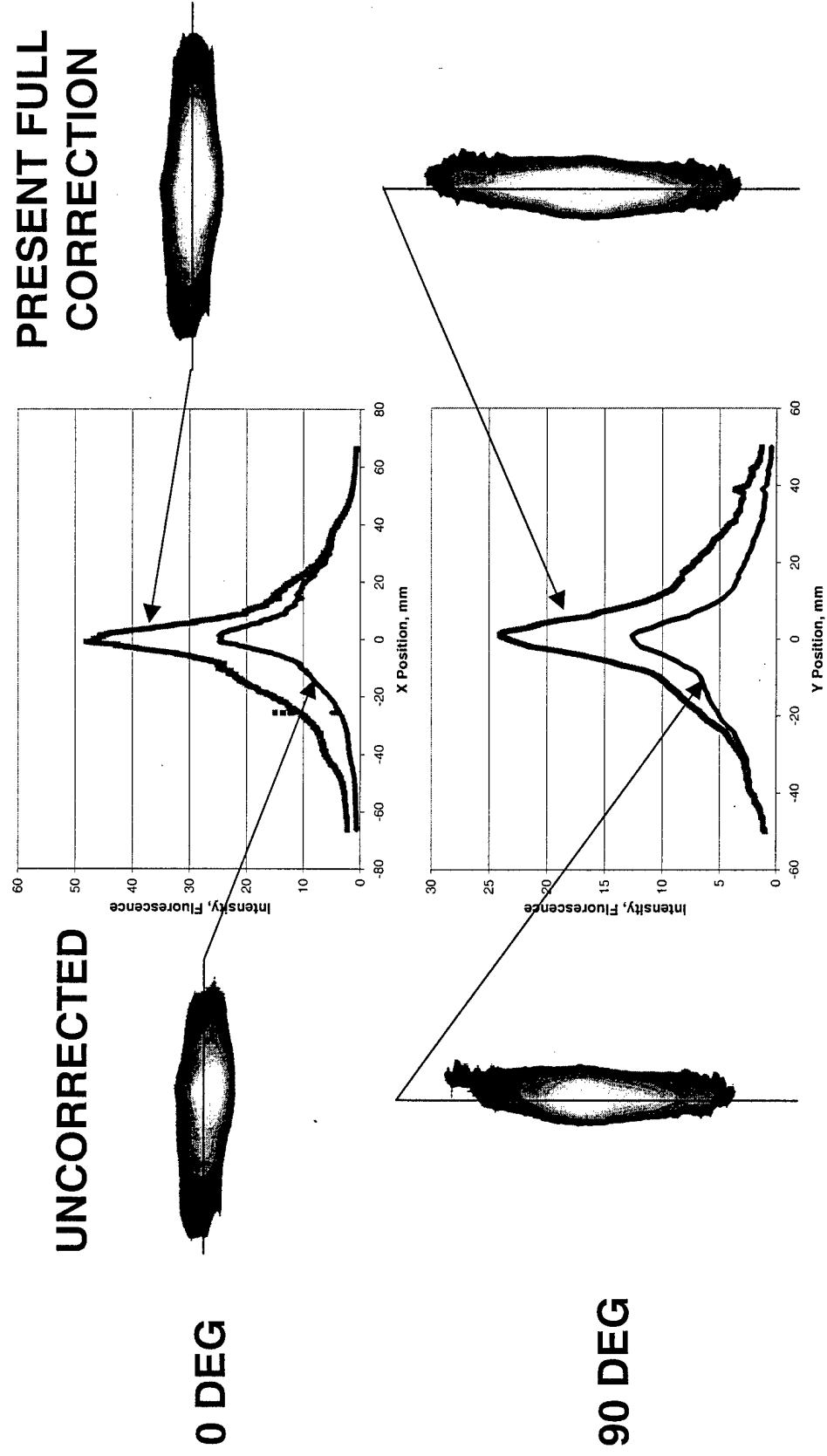


90 DEG



DEMONSTRATION STUDY

- IMPORTANCE OF CORRECTION: LINE PROFILES



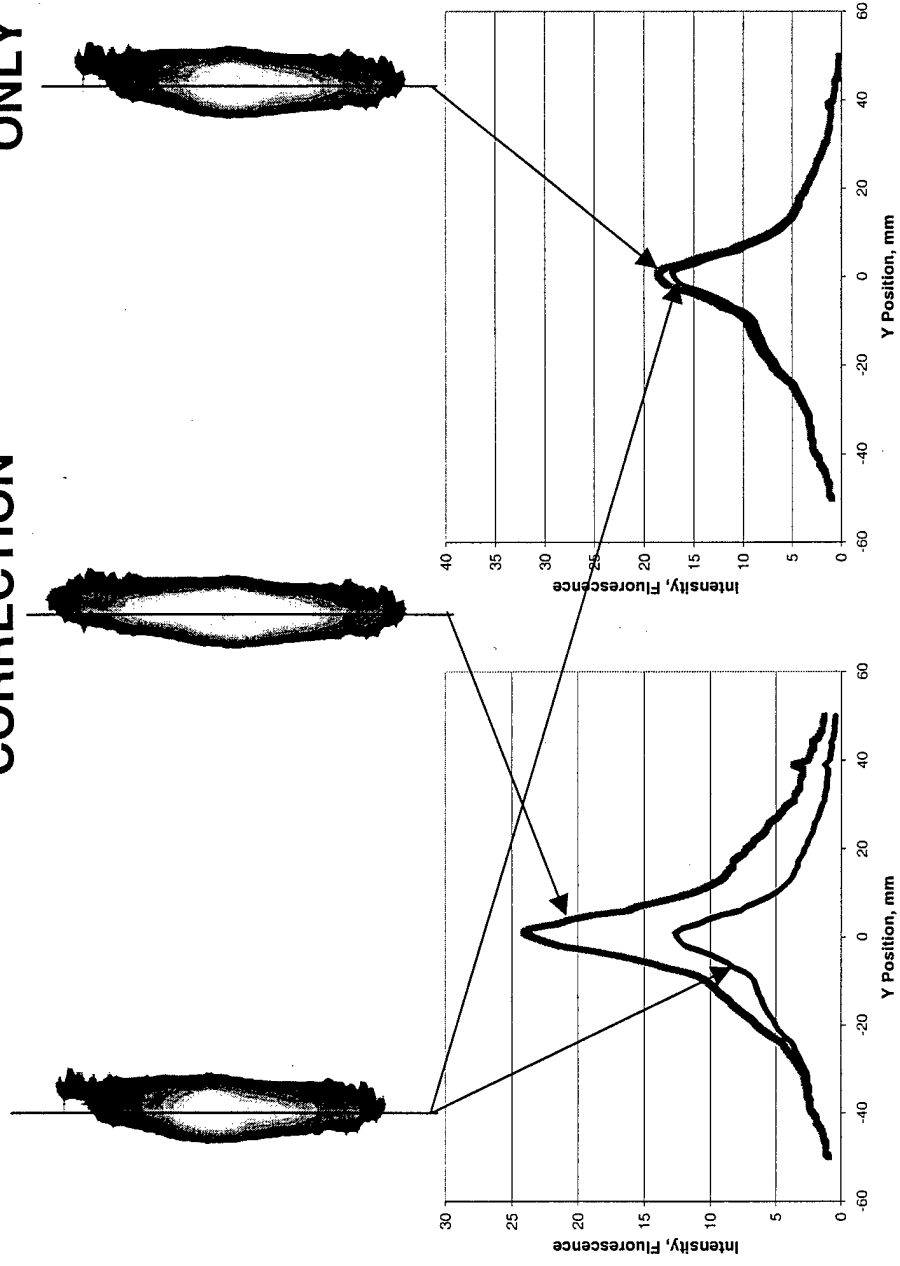
DEMONSTRATION STUDY

- IMPORTANCE OF CORRECTION FOR SIGNAL: 90 DEG ORIENTATION

CORRECTION FOR
INCIDENT LIGHT
ONLY

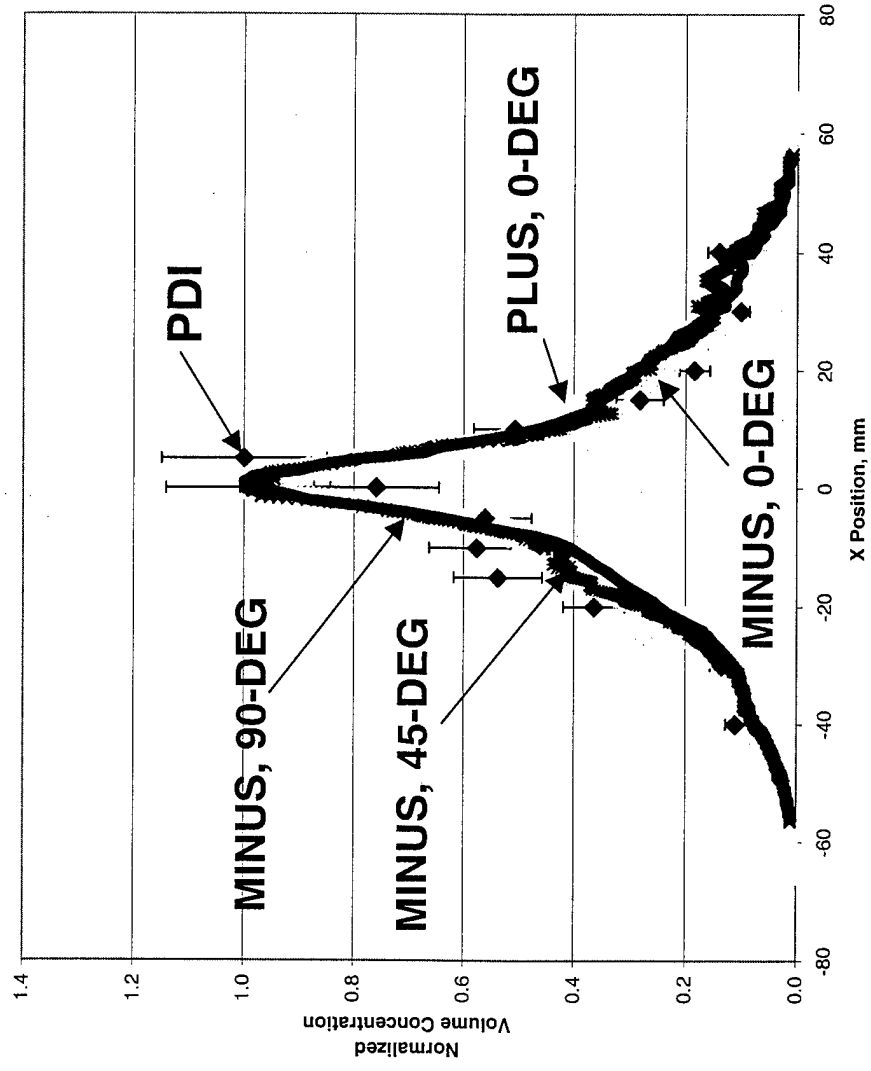
PRESENT FULL
CORRECTION

UNCORRECTED



DEMONSTRATION STUDY

- COMPARISON OF CORRECTED VOLUME CONCENTRATION TO PDI



CONCLUSIONS

- CORRECTION REQUIRED FOR ACCURATE RESULTS IN SPRAYS WITH SIGNIFICANT OPTICAL THICKNESS
 - INCIDENT LIGHT
 - SIGNAL LIGHT
- METHODOLOGY HAS BEEN DEVELOPED TO ACCOUNT FOR ATTENUATION OF BOTH INCIDENT AND SIGNAL LIGHT
- DEMONSTRATIONS TO DATE HAVE REVEALED GOOD PERFORMANCE
 - 63% "OBSCURATION"

MEMORANDUM FOR PR (Contractor/In-House Publication)

FROM: PROI (TI) (STINFO)

23 Jun 2000

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-TP-2000-140**
V. McDonel (ERC); D. Talley (AFRL/PRSA), "Correcting for Attenuation Effects in Optical
Patternation of Sprays"

**10th International Symposium on Applications of Laser Techniques to Fluid (Statement A)
Mechanics (Lisbon, Portugal, 10-13 Jul 00)**
8th International Conference on Liquid Atomization and Spray Systems
(Pasadena, CA, 16-20 June 00) (Submission Deadline: 19 Jun 00)

1. This request has been reviewed by the Foreign Disclosure Office for: a.) appropriateness of distribution statement,
b.) military/national critical technology, c.) export controls or distribution restrictions,
d.) appropriateness for release to a foreign nation, and e.) technical sensitivity and/or economic sensitivity.
Comments: _____

Signature _____ Date _____

2. This request has been reviewed by the Public Affairs Office for: a.) appropriateness for public release
and/or b) possible higher headquarters review.
Comments: _____

Signature _____ Date _____

3. This request has been reviewed by the STINFO for: a.) changes if approved as amended,
b.) appropriateness of distribution statement, c.) military/national critical technology, d.) economic sensitivity,
e.) parallel review completed if required, and f.) format and completion of meeting clearance form if required
Comments: _____

Signature _____ Date _____

4. This request has been reviewed by PR for: a.) technical accuracy, b.) appropriateness for audience, c.)
appropriateness of distribution statement, d.) technical sensitivity and economic sensitivity, e.) military/
national critical technology, and f.) data rights and patentability
Comments: _____

APPROVED/APPROVED AS AMENDED/DISAPPROVED

LESLIE S. PERKINS, Ph.D (Date)
Staff Scientist
Propulsion Directorate